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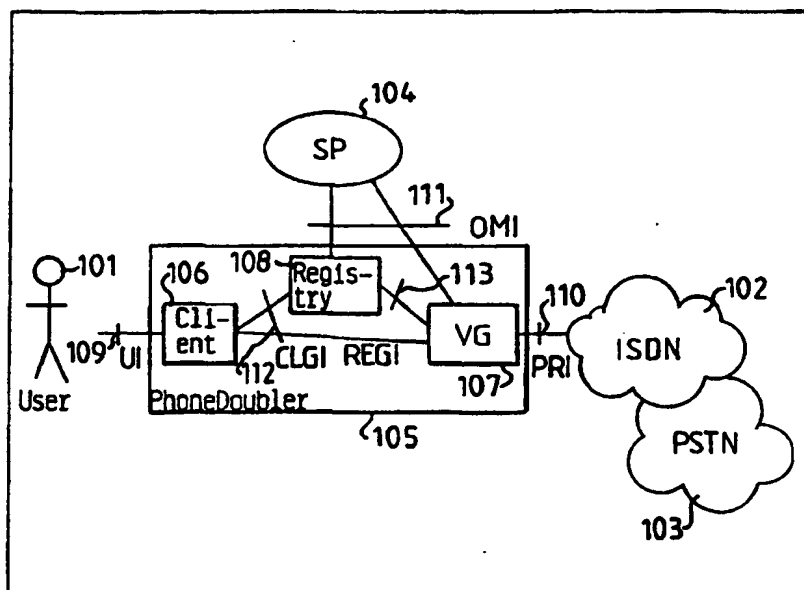
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(54) Title: INCOMING CALL ROUTING



(57) Abstract

The purpose of the present invention is to be able to route incoming calls in an efficient manner. The problem described with how to route incoming calls in an efficient manner is solved by diverting the incoming call to a service node which further diverts the call to a specific node in dependence of the telephone number of the called party in combination with other characteristics.

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INCOMING CALL ROUTING**TECHNICAL FIELD OF INVENTION**

The present invention relates to telecommunication in general and to voice communication over the Internet in particular.

5 DESCRIPTION OF RELATED ART

As Internet is being more and more popular we tend to spend more and more time in front of our computers while connected to Internet. The most common way of connecting to Internet is by using a modem and the connection times is far longer than the
10 time usually spent in a traditional voice conversation. For home users the use of the telephone line for connectiong to Internet can lead to a conflict since most subscribers only have one line which shall serve both computer communication and voice communication.

15 In the Swedish patent application SE-9602212-4 is a method for enabling a subscriber to make and receive voice calls during an on-going Internet session disclosed.

In the Swedish patent application SE-9603932-6 the methods disclosed in SE-9602212-4 is further developed and additional
20 problems solved.

The general idea of the above mentioned applications is that a user, connected to Internet via a modem using his ordinary telephonenumber, register with a service using a special application in his computer. The service connects the users
25 telephone number to a special number activating a IN service so

that whenever a call is placed towards the user, it is redirected to the special number. When the IN service is activated it activates a gateway which connects, via Internet or the service providers own IP-based network, to the application
5 in the users computer and alerts the user who can then answer the call.

In a similar manner, the user can place an outgoing call using the gateway to act as a bridge between the IP-based Internet and PSTN. In this situation it seems from the PSTN network point-of-
10 view as if the gateway is making the call and should be charged. A solution to this problem is presented in SE-9603932-6.

None of the above mentioned applications discloses specific methods for routing incoming calls to the client in a manner which maximise the utilisation of the networks, both the
15 telecommunication network and the IP-based network.

SUMMARY OF THE INVENTION

The present invention discloses a method and a network for solving the problem with routing of incoming calls for increased utilisation of the networks.

20 The purpose of the present invention is thus to be able to route incoming calls in an efficient manner.

The problem described above, with how to route incoming calls in an efficient manner is solved by diverting the incoming call to a service node which further diverts the call to a specific node
25 in dependence of the telephone number of the called party in combination with other characteristics.

In more detail, the problem described above is solved by divert the telephone number of the users telephone to a service node so that incoming calls will be diverted to said service node. When said service node detects an incoming call it analyses the A-
5 number called, the location of the user associated with said A-number and the location, or other characteristics, of the multitude of nodes and divert the incoming call in dependance of said analysis.

One of the advantages of the present invention is that the
10 network is utilised in an efficient manner.

Another advantage is that the traveling time of the IP-packages may be minimised and thereby reducing disturbances in the quality of service.

Other advantages will be obviouse to a man skilled in the art in
15 the light of the detailed description given below.

Further scope of applicability of the present invention will become apparent from the detailed description given herein after. However, it should be understood that the preferred
embodiments of the invention, are given by way of illustration
20 only, since variouse changes and modifications within the scope of the invention will become apparent to those skilled in the art from this detailed description

BRIEF DESCRIPTION OF DRAWINGS

Figure 1 discloses the interfaces for the phonedoubler.

Figure 2 discloses a more detailed view of the network configuration.

Figure 3 shows a network configuration for the routing of incoming calls.

5 Figure 4 shows a network configuration of another preferred embodiment.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Figure 1 depicts the Phone Doubler network and its external interfaces to external networks, users and units. A User 101 is the person using Phone Doubler at home. The user 101 is also the subscriber of the service. A ISDN 102 (Integrated Services Digital Network) is used as gateway to a PSTN 103 (Public Switched Telephone Network). An SP 104 (Service Provider) is the system, organisation and persons responsible for the successful operation of Phone Doubler 105. Also In figure 1 is the Phone Doubler inner structure showed. Client 106 is the part of Phone Doubler that is located at the user's premises. A Registry 108 is a node within the gateway that is common for all users of the Phone Doubler service. This node is referred to as the registry in the remainder of this document. A VG 107 (Voice Gateway) is the unit that processes all calls and speech transmission. A VG 107 can handle a number of simultaneous calls. In figure 1 are also the interfaces external to the network and nodes identified. A UI 109 (User Interface) is the interface between the User 101 and the Client 106. PRI 110 (ISDN Primary Rate Interface) is the interface used between the VG 107 and the ISDN 102. OMI 111 (Operation and Maintenance Interface) is the

interface between SP 104 and the registry 108 and VG 107. A CLGI 112 (Client Gateway Interface) is the interface between the Client 106 and the registry 108 respectively the client and the VG 107. A REGI 113 (Registry Interface) is the interface between
5 the registry 108 and the VG 107.

Referring to figure 2, the client 201 is running on a PC (not shown), connected to the ISP's (Internet Service Provider) AS 207 (Access Server) at the ISP's POP (Point Of Presence) via a modem 202 and PSTN 203. The PC is given an IP address by the
10 ISP. This is normally done dynamically when connecting to the POP. In the present preferred embodiment the ISP and the SP 104 is the same organisation or service provider. The VG 203, 204 is connected to the ISP's IP network, typically on the same ES 205, 206 (Switched Ethernet) as the POP. Several VGs 203, 204 can be
15 connected at one POP. Each VG 203, 204 is connected to ISDN 208 via PRI 209, 210. One Registry node 211, 212 can handle several VG:s 203, 204. The Registry node 211, 212 can physically be remotely placed. The VG 203, 204 and Registry 211, 212 are then typically connected to each other via the ISP's backbone IP
20 network 213. The Registry node 211, 212 is normally duplicated for redundancy reasons. Several Routers are denoted with an R in figure 2.

In figure 3 a client 301 is connected to a service providers IP-network 302. For his connection he uses a modem 303 and the PSTN
25 network 304. The PSTN network 304 is connected with the ISDN network 305 which in turn is connected to the service providers IP-network through a modem pool 306. The service providers IP-network is also connected to Internet 307 via a router 308. A

subscriber 309 calls the client 301 over the PSTN network 304 but will of course get a busy tone if not the client 301 has diverted his telephone. The client 301 has diverted his telephone to a IN service located in an SSCP 310. This could of course also be an SSP and a separate SCP but for this embodiment an SSCP is sufficient. Two VG:s 311 and 312 (Voice Gateway) connects the ISDN network 305 with the service providers IP-network. The SSCP is constantly updated with the load situation on the different VG:s and divert the incoming call to VG 312 which for the moment is the VG with the lowest load. Through this procedure the IP-packets delivered from the VG 312 to the client 301 will have minimum delay.

Figure 4 shows an embodiment for devirting on geographic location. In this situation it is preferable to have the longest part of the call in the PSTN network so the SSCP 401 diverts the incoming call from the subscriber 402 to the VG 403 closest to the client 404.

The central registry nodes may serve several distributed voice gateway modules and form a wide area distributed gateway.

20 Wide-area distribution issues

As long as the gateway contains a single set of VGs collocated with the POP access server, sufficient IP throughput between modems and VGs is simple to ensure (all devices reside in the same LAN environment). A single ISDN group number will also be sufficient to server all VGs.

When the Phone Doubler service is scaled up to form a wide area gateway, each POP has one or several VGs, served by a central registry node. This ensures that voice traffic is guaranteed to have minimum latency and jitter, since the voice traffic through
5 routers is avoided.

Client data

The client has the following data:

- Telephone number, made up from country code, area code¹, and local number. Example: "46-08-6678054"
- 10 • Authentication data which is in the present preferred embodiment a ONF (One way Function) applied to the concatenation of country code, area code, local number and password. (optional, persistent)
- Client IP address (volatile)
- 15 • Host name 1 of registry.
- Host name 2 of registry.
- Primary VG IP address (volatile)
- Secondary VG IP address (volatile)
- Reject incoming calls (volatile)
- 20 All of these data can be obtained at the sign-on procedure except for Telephone number and Authentication data.

The combination of country code, area code, and local number identifies each subscriber uniquely.

¹ Optional in markets such as Denmark, where area codes are not used.

The *VG IP address* attribute also represents the state of the client: A null address indicates *signed-off*, any other address indicates *signed-on*.

REGISTRY DATA

5 Subscriber record

Both the registry nodes holds an identical collection of *subscriber records* with the following attributes:

- telephone number (key, persistent, made up from country code, area code, and local number)
- 10 • authentication data, A ONF applied to telephone number concatenated with password (persistent)
- state. Enabled or disabled.
- client IP address (secondary key, volatile)
- user-id (optional)
- 15 • primary VG (volatile)
- secondary VG (volatile)
- number of sign-ons (persistent)
- number of incoming calls (persistent)
- number of outgoing calls (persistent)
- 20 • first sign-on (persistent)
- last sign-on (persistent)

The *client IP address* attribute also represents the state of the subscriber record (a null IP address represents *signed-off*, any other address represents *signed-on*).

25 E.164- IP-address association

When a user is connected to the Internet, the IP address of the client is entered into the subscriber record in both registry nodes. Since both the telephone number and this IP address are keys, an *E.164- IP-address association* between the telephone
5 number and IP address is maintained in the subscriber record.

Registry configuration data

The following data are configurable in the registry:

Data that are to identical in both registry nodes:

- 10 • User provisioning mode, automatic or manual.
- Auto sign-off period (optional, must be greater than the PPP inactivity time-out)
- Number of password retries
- Auto removal period (optional)
- 15 • Country code
- Trunk prefix (optional)
- SMTP-mail server (for e-mail-based alarm handling)
- Mail receivers (list of e-mail addresses that will receive alarms)
- 20 • *Time synchronization host*. Host name to time synchronisation host

Data that are unique for each registry node

- Host name of redundant registry node. (optional)
- FTP account in redundant registry node
- 25 • Emergency numbers

Data that may be equal in both nodes:

- Hosts granted access to the WWW-server
- Hosts granted access to the FTP-server

VG record

5 The gateway configuration is defined by a set of VG records.
This set of records is held by the registry, and updated on
certain events such as start-up and shut-down of VGs.

- IP Address (key)
- Name
- Primary client networks (only clients in these networks are
10 served by this VG during normal operation)
- Secondary up client networks (clients in these networks may
be served by this VG when an other VG fails)
- Maximum signed-on users
- Currently primary signed-on users
- 15 • Currently secondary signed-on users

VG configuration data

The VG holds a set of configuration data that are unique for
each VG:

- Dial out prefix
- 20 • IP-addresses of registry. Optionally two, if redundant
register.
- Monitor interval.
- Number extraction method (calling (A), called (B) or
redirecting number)
- 25 • Hosts granted access to the FTP-server

- Network charging

Sign-on and sign-off functions

Purpose

To make it possible for the user to be connected to the Internet
5 Service Provider's point-of-presence (POP), using his telephone
line, and still be able to use that line and number for incoming
and outgoing telephone calls.

The following addresses are of importance in these functions:

- the user's telephone number
- 10 • the client IP address
- the ISDN number of the gateway

General

The sign-on and sign-off functions comes in two flavours,
depending on the setting of the authentication mode attribute of
15 the registry configuration.

In the auto provisioning mode the user is allowed to use the
service if it's IP-address matches any client networks
attribute of the VG-records. In this case the PoP's
authentication is trusted and once passed, the user is trusted.

- 20 In this mode only charging on IP-addresses may be used and thus
network charging. We can't trust the telephone number the user
states.

The other, manual, mode means that user must be registered in
the system by some administrative procedure into the system, see

the subscriber management function. In order to use the service in this mode the users have to go through an authentication procedure also in the Phone Doubler system.

The authentication procedure is based on the challenge response mechanism [Ref. Computer Communications Security, Warwick Ford, Prentice Hall, ISBN 0-13-799453-2]. As ONF the MD5 algorithm can be used [RSA Data Security, Inc. MD5 Message-Digest Algorithm]. ONF(X+Y) denotes below the application of the one way function to the concatenated string X+Y.

10 Sign-on in auto provisioning mode

This usage case may only be entered if the state of the client is *signed-off*. Prior to this usage case the user is assumed to have set up Call Forwarding or (better) Call Forwarding on Busy to the ISDN number of the VG. This can be done with a telephone set or otherwise (software support for this is not provided in the product). In another embodiment the Call Forwarding is handled automatically by the service.

The client checks that the user's Internet session is active. The client saves its current IP address in the *client IP address* attribute of the client, for reference by other usage cases (*outgoing call set-up* and *sign-off*). The client connects to the registry and transfers the telephone number of the user. The registry retrieves the IP address of the client as a parameter of the ongoing TCP session. Note that the client IP address will be different between Phone Doubler sessions if DHCP is in use.

The registry selects a VG and hands over its IP address to the client. The selection of a VG is done by the registry as follows: (1) select those VG records for which the user's IP address match the *primary client networks* attribute of the VG,
5 (2) select the VG record having the greatest difference between *maximum signed-on users* and *primary signed-on users*, (3) check that the maximum signed-on users limit will not be exceeded for the selected VG, and (4) check that the selected VG is not *disabled*. The selected VG record's *currently primary signed-on*
10 attribute is incremented.

The registry checks for the existence of a subscriber record with the stated telephone number. A check is made that the client IP address is not associated with any telephone number in the registry at this point. A check is made that the state of
15 the subscriber record is *enabled* and *signed-off*.

The subscriber record is updated (the *client IP address*, *number of sign-ons*, and *last sign-on* attributes are updated). The PSTN-IP association is thereby established, and the previous checks ensure that it is unambiguous in both directions. The *currently*
20 *signed-on users* attribute of the VG record is incremented. The VG IP address is set in the client. The client disconnects from the registry.

If the Internet session is not active the user is advised to start an Internet session and try to sign on again. If the
25 registry is not accessible, the user is informed of this and asked to retry later. The incoming and outgoing call functions

will not be available until the client has been successfully signed on. The usage case is terminated.

If the client IP address is not acceptable according to any of the *client networks* parameters in the VG-records the usage case is terminated. No information is presented to the user, as this exception may be a case of illegal use.

If, due to lack of resources, no VG is available to select, the user is informed of this. The client disconnects from the registry and the usage case is terminated.

10 If no subscriber record exists for the telephone number provided by the client, a new subscriber record is created. The following attributes are filled in: *telephone number*, *client IP address*, *first sign-on*. Obvious default values are filled in for the remaining attributes. After this the present usage case may
15 proceed. In another embodiment is no new subscriber record created but rather the usage case terminated.

If, prior to this usage case, the client IP address is associated to some user's telephone number in the registry, this association is obviously invalid. The forced sign-off usage case
20 is executed repeatedly for every such telephone number, until no association from the client IP address to some user's telephone number remains. After this the present usage case may proceed.

If the subscriber record indicates that the user is already signed on (from any client IP address), the forced sign-off
25 usage case is executed. After this the present usage case may proceed.

If the subscriber's state is disabled the user is rejected access and the usage case is terminated.

Sign-on manual mode

The difference in this case is that the user has to be defined
5 by the service provider prior to sign-on. In the below the addition to the auto mode case is described.

The client first request to start the sign-on procedure by signalling this to the registry. In this message the telephone number is transferred.

10 The registry checks that a subscriber record, with that telephone number as key, exists and retrieves a non repeating value (NRV) and associates that NRV with the subscriber. This NRV is sent to the client which then responds with ONF(ONF(telno+password)+NRV).

15 NRV can be for instance current time is milliseconds.

ONF(telno+password) is either fetched from the client configuration or calculated as result of a password prompt dialogue with the user. Which mechanism to use is user defined.

The registry takes the authentication data (AD) in the
20 subscriber record, then compares ONF(AD+NRV) with the value received from the client. If these values are equal the user is authenticated and a counter of authentication failures to zero.

If the user is non existing the user is informed that he has to contact the service provider to be registered.

On authentication failure a counter authentication failures is incremented. If this counter exceeds *number of password retries* the user is disabled.

If the user already is signed on he is informed of this.

- 5 In all other parts the exceptions from the auto case remains.

Sign-off, auto mode

The client checks that its state is *signed-on*.

- 10 A reminder to cancel his *Call Forwarding* setting is presented to the user. Unfortunately, cancellation of Call Forwarding cannot be done until the Internet session is finished (outside the scope of the Phone Doubler product).

The *forced sign-off* usage case is executed.

The client disconnects from the registry.

- 15 If the client state is not *signed-on*, the usage case is terminated with no further action (shutdown of the client may proceed).

- 20 If the registry is not accessible, the usage case is terminated. Shutdown of the client may proceed. This will lead to an invalid association between the user's telephone number and the client IP address, lasting until it is cleared by a *sign-on*, *auto-sign-off* or *incoming call set-up* usage case.

Sign-Off, manual mode

The client checks that its state is *signed-on*.

A reminder to cancel his *Call Forwarding* setting is presented to the user. Unfortunately, cancellation of *Call Forwarding* cannot be done until the Internet session is finished (outside the scope of the *Phone Doubler* product).

- 5 The *forced sign-off* usage case is executed.

The client disconnects from the registry.

If the client state is not *signed-on*, the usage case is terminated with no further action (shutdown of the client may proceed).

- 10 If the registry is not accessible, the usage case is terminated. Shutdown of the client may proceed. This will lead to an invalid association between the user's telephone number and the client IP address, lasting until it is cleared by a *sign-on*, *auto-sign-off* or *incoming call set-up* usage case.

- 15 **Forced sign-off**

Other usage cases relying on this one are: *Sign-on*, *Sign-off*, *Incoming call set-up*, *Auto-sign-off*.

The association between the user's telephone number and the client IP address is broken (The subscriber record is updated).

- 20 In the VG records, corresponding to the subscriber record's primary and secondary VG, the current primary and secondary signed-on users is decremented.

The *registry log* is updated.

Auto-sign-off

This usage case is executed periodically in the registry, without manual intervention. The purpose is to remove incorrect information from the subscriber records. The periodicity is given by the *auto sign-off period* attribute of the registry. It should be reasonably short, since this is how an accidentally disconnected user gets salvaged and can sign on again. It must however be longer than the PPP inactivity time-out, in order not to interfere with that function of the ISP's Internet service.

Examine each subscriber record and carry out the steps below:

- 10 If the state of the subscriber record is *signed-on*, verify that the client is actually alive by connecting to it. If the client is not alive, execute the *forced sign-off* usage case for this subscriber.

- If the client is alive but its telephone number does not match the *telephone number* attribute in the subscriber record, issue a *number inconsistency at auto-sign-off* alarm and execute the *forced sign-off* usage case for the subscriber indicated by the subscriber record.
- 15

- If the client has not been signed on for a very long time (according to the *auto removal period* defined in the registry), the subscriber record is deleted.
- 20

Relation between client UI and usage cases

The UI of the client is closely related to the sign-on and sign-off usage cases.

When the client is started it will establish a connection to the ISP's IP network, if not done already by some other application. The sign-on usage case will then be executed automatically.

The client UI also provides a menu choice or push-button by which the user may request a sign-on. This is meaningful e. g. if the initial sign-on failed for some reason.

When the client is terminated the sign-off usage case is executed automatically.

Incoming call function

10 The incoming call function makes it possible for the user to be connected to the point-of-presence (POP), using his telephone line, and still be able to receive telephone calls on that line and number.

The A-party is the party calling the user's telephone number, which is diverted to the ISDN group number of a VG cluster. In another embodiment the telephone number of the user may be diverted to a IN service.

Addresses

The following addresses are of importance in this function:

- 20 • the user's telephone number
- the client IP address
- the A-part's telephone number
- the voice gateway's ISDN-number

Usage cases

Incoming call set-up

A-part dials B-part's telephone number, which is forwarded to the UAN (Universal Access Number).

5 The call is originated from the PRI interface. During call set-up the B-part's telephone number is extracted from the Q.931 signalling over PRI. The type of number to extract is configured in the *number extraction method*.

If the *trunk prefix* parameter is present its value is prepended to the B-number.

10 Then the *country code* parameter is prepended to the B-number.

The VG connects to the registry and looks up the subscriber record of the B-part's telephone number. The client IP address is retrieved from this record.

The VG disconnects from the registry.

15 A connection is established to the client, using the IP address that was fetched from the registry.

The client indicates an incoming call to the user via the UI. The A-party's telephone number is not presented.

Any of the following usage cases are then possible:

- 20
- Incoming call answer
 - Incoming call reject
 - Incoming call A-part hangs up during ringing
 - Incoming call ISDN time-out during ringing

If the VG is disabled the B-part is signalled to be busy in PRI and the usage case is terminated.

If the B-parts telephone number is not provided in PRI the call cannot be handled. The B-part is then signalled to be congestion
5 in PRI and the usage case is terminated.

If VG fails to connect to the registry and the registry is redundant this usage case continues with the using the other registry.

If the VG fails to connect to the registry the B-part is
10 signalled to be busy in PRI and the usage case is terminated.

If there is no subscriber record for the provided B-number, the call cannot be handled. The VG disconnects from the registry, the B-part is signalled to be busy in the PRI and the usage case is terminated.

15 If the B-part's telephone number is not associated with an IP address, the VG disconnects from the registry and the B-part is signalled to be busy in the PRI. The usage case is then terminated. This exception will occur for a user who has signed off and forgotten to cancel his call forwarding.

20 If the establishment of a connection to the client on the indicated IP address fails, the B-part is signalled to be busy in PRI. The present usage case is then terminated.

If the connection to the client succeeds, but the telephone number of the client is not equal to the B-part's telephone

number, the B-part is signalled to be busy in PRI. The present usage case is then terminated.

If the *reject incoming calls* flag is set in the client the B-part is signalled to be busy in PRI and the usage case is terminated.

If the client software is busy the B-part is signalled to be busy in PRI and the usage case is terminated.

If the client cannot allocate any audio device a message is presented to the user. This message informs him that there is an incoming call, and that he has two options: (1) terminate the application that uses audio and pick up the call, or (2) reject the call. If (2) is selected, the B-part is signalled to be busy in PRI and the usage case is terminated. If (1) is selected, another attempt is made to set up the call. Should this attempt also fail because the audio device is not free, the same message and options are presented repeatedly.

Incoming call answer

This usage case can only occur after the incoming call set-up has succeeded. The user chooses to answer the call. The client updates its status message. Speech transmission starts.

Incoming call reject

This usage case can only occur after the incoming call set-up has succeeded.

The B-part is signalled to be busy in the PRI.

All resources that were allocated for the call are released in the client and the VG. The VG disconnects from the client.

Incoming call A-part hangs up during ringing

This usage case can only occur after the incoming call set-up
5 has succeeded.

This usage case is triggered from the PRI.

All resources that were allocated for the call are released in the client and the VG. The user is informed that the A-part has hung up.

10 The VG disconnects from the client.

Incoming call ISDN time-out during ringing

This usage case can only occur after the incoming call set-up has succeeded.

This usage case is triggered from the PRI. It occurs after a
15 while if the B-part (i. e., the Phone Doubler user) does not act at all, and the A-part does not hang up.

All resources that were allocated for the call are released in the client and the VG. The user is informed that the call was disconnected.

20 The VG disconnects from the client.

Incoming call B-part hangs up during talking

This usage case can only occur after the incoming call answer has succeeded, i. e. when speech transmission has been established.

5 All resources that were allocated for the call are released in the client and the VG, and on-hook is signalled in the PRI. The VG disconnects from the client.

Incoming call A-part hangs up during talking

10 This usage case can only occur after the incoming call answer has succeeded, i. e. when speech transmission has been established.

This usage case is triggered from the PRI. All resources that were allocated for the call are released in the client and the VG.

15 The user is informed that the A-part has hung up (the VG does not wait for user confirmation of this message).

The VG disconnects from the client.

Outgoing call function

20 To allow a user to make outgoing telephone calls to PSTN/ISDN while being connected over his telephone line to the ISP's point-of-presence (POP).

The following addresses are of importance in this function:

- the B-part's telephone number
- the A-part's IP address

To understand how these addresses are managed please refer to the configuration management function.

Usage cases

5 The client performs a very limited number analysis of the B-number.

Outgoing call set-up

It is required that the state of the client is *signed-on*.

A-part dials B-part's telephone number. No number analysis is performed in the client.

- 10 The client checks that its current IP address, as reported by the operating system, equals the previously saved *client IP address* attribute of the client.

The client checks for the existence of a free audio device on the client platform and reserves it.

- 15 A connection is established to the VG that was assigned to the client at sign-on.

A check is made that the IP address of the client may actually be served by the VG.

- 20 The dialled number is transferred to the VG. A very limited number analysis is performed as follows: If the *trunk prefix* parameter of the VG is non-empty. A check is made that the leading digits of the dialled number do match the trunk prefix.

If the *dial-out* parameter is present its value is prepended to the dialled number.

An ISDN call is set up to the called number.

If the *network* charging parameter is true the user's telephone
5 number is signalled as user provided A-number in the PRI.

If the current client IP address differs from the previously
saved *client IP address* attribute, the state of the client is
set to *signed-off*. The user is advised to sign on again, and the
usage case is terminated. This situation may arise if a user
10 signs on, the PPP connection goes down, and a new PPP connection
with a different client IP address is established.

If the client cannot allocate any audio device the user is
informed of the reason and asked to close any application using
the audio devices and then retry.

15 If the connection to the VG cannot be established, or if the
state of the VG is *disabled*, the client tries to connect to the
secondary VG. If this fails the user is advised to close the
client and restart it (on the hypothesis that the user will thus
be assigned another and better suited VG). The audio device is
20 released and the usage case is terminated.

If the client IP address is not accepted by the VG a *rejected IP
address at outgoing call* alarm is issued. The audio device is
released and the usage case is terminated.

If the VG has no free capacity the user is informed of this and advised to retry later. A VG capacity exceeded alarm is issued. The audio device is released and the usage case is terminated.

5 If the trunk prefix parameter of the VG is non-empty and the leading digits of the dialled number do match the trunk prefix a check is made if the dialled number is an emergency number. If it is an emergency number the usage case continues other wise the user is informed of that the number has an illegal format and the usage case is terminated.

10 If the called number cannot be reached the user is informed of the reason (busy, congestion, etc.). The audio device is released and the usage case is terminated.

Outgoing call answer

15 This usage case can only occur after the outgoing call set-up usage case has succeeded.

The B-part chooses to answer the call.

The client updates its status message.

Speech transmission starts.

Outgoing call reject

20 This usage case can only occur after the outgoing call set-up usage case has succeeded.

The B-part chooses to reject the call (as may occur if the B-part uses a GSM telephone). The VG sees a busy signal in the PRI.

All resources that were allocated for the call are released in the client and the VG. The user is informed that the B-part rejected the call (the VG does not wait for user confirmation of this message).

- 5 The VG disconnects from the client.

Outgoing call A-part hangs up during ringing

This usage case can only occur after the outgoing call set-up usage case has succeeded.

The user hangs up before the B-part has acted.

- 10 All resources that were allocated for the call are released in the client and the VG. The status message in the client is reset to the idle message.

The VG disconnects from the client.

Outgoing call ISDN time-out during ringing

- 15 This usage case can only occur after the outgoing call set-up usage case has succeeded.

This usage case is triggered from the PRI. It occurs after a while if the B-part does not act at all, and the A-part does not hang up.

- 20 All resources that were allocated for the call are released in the client and the VG. The user is informed that the call was disconnected by ISDN.

The VG disconnects from the client.

Outgoing call A-part hangs up during talking

This is how successful outgoing calls are usually terminated.

This usage case can only occur after the outgoing call answer has succeeded, i. e. when speech transmission has been
5 established.

All resources that were allocated for the call are released in the client and the VG. The status message in the client is reset to the idle message.

The VG disconnects from the client.

10 Outgoing call ISDN disconnect during talking

This usage case occurs only infrequently.

This usage case can only occur after the outgoing call answer has succeeded, i. e. when speech transmission has been established.

15 The B-part hangs up. After a while the ISDN network disconnects the call (the VG sees this in the PRI).

All resources that were allocated for the call are released in the client and the VG. The user is informed that the call was disconnected by the B-part (the VG does not wait for user
20 confirmation of this message).

The VG disconnects from the client.

Subscriber management function

To make it possible to administrate the subscribers of the service. The need for service is expected to be small, consisting of occasionally deleting a subscriber record for which the password has been lost.

5 Usage cases

Automatic subscriber removal

The subscriber record of a user that does not sign on for a very long time gets deleted from the registry. See the *auto-sign-off* usage case under Fault Management. This will limit the subscriber table in the registry to consist of reasonably active Phone Doubler users. A user that gets removed from the registry can sign on again at any time.

Subscriber provision

A management system can add a specified users via the OMI FTP-interface.

A human administrator can remove a specified user via the OMI HTTP-interface.

Changes made in one registry node are replicated to the redundant registry node.

20 Subscriber removal

A management system can remove a specified users via the OMI FTP-interface.

A human administrator can remove a specified user via the OMI HTTP-interface.

Changes made in one registry node are replicated to the redundant registry node.

Add and remove subscriber to/from blacklist

The subscription's state is set to disabled/enabled.

5 Can be done via HTTP and FTP

Change password of subscriber

Can be done via HTTP and FTP.

Subscriber analysis

10 A human administrator can retrieve the subscriber-records via the OMI HTTP-interface.

Authentication function

The authentication scheme is described in the sign-on and sign-off function.

15 To prohibit illegitimate use of the service. In particular, to reduce the risk that someone states the telephone number of another Phone Doubler user at sign-on.

Charging function

Charging is supported in a number of ways:

20 Registry logs is generated and can be retrieved for the purpose of charging periodical fees or statistical purposes.

Call logs are generated and can be retrieved for the purpose of charging per call charges or statistical purposes.

In manual provisioning mode users can be authenticated to be the legitimate user of its telephone number or user-id.

- 5 Users can be charged based on their IP-address if the charging system can determine the user of a certain IP-address at a certain time. This must be based on logs from the access servers if DHCP is used.

Incoming calls can be charged based on service rates on the UAN.

- 10 In manual provisioning mode outgoing calls can be made with user provided A-number which can be used in the telephone networks charging system for charging of outgoing calls.

Performance management function

- 15 To make it possible for the SP to monitor and adjust the resource utilisation of this service in the network.

Traffic in and out of the gateway is measured on the ISDN side, for which well known and understood tools and methods exist.

The registry log can be used for statistical analysis of sign-on and sign-off behaviour.

- 20 The call logs can be used as complement to the ISDN tools to analyse the telephony behaviour.

An alarm is sent if capacity was exceeded at outgoing call.

The invention being thus described, it will be obviouse that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications as would be obvoius to a
5 man skilled in the art are intended to be included within the scope of the following claims.

CLAIMS

1. A method for routing incoming calls to a first subscriber towards a specific node, said first subscriber using a telecommunication network for connecting to Internet and said node being connected to both Internet and said telecommunication network characterised in that a second subscriber calls said first subscriber over said telecommunication network, that said call is diverted to a service node, that said service node selects one specific node from a multitude of nodes connected both to Internet and to said telecommunication network in dependance of the telephone number of said first subscriber and that said call is further diverted to said specific node.
2. A method according to claim 1, characterised further in that said service node selects a specific node from a multitude of nodes connected both to Internet and to said telecommunications network in further dependance of the geographic location of said specific node or in further dependance of the signalling location of the specific node or in dependance of load information from the multitude of nodes.
3. A method according to claim 2, characterised in that said service node selects the node which will minimise the geographic distance between the first subscriber and said node or which will minimise the signalling distance between the first subscriber and said node or which will minimise the travelling time for IP-packets sent from said node to the

first subscriber and back or which will minimise the load on said node.

4. A method according to claim 1, **characterised** in that said service node is a Service Control Point in an Intelligent Network.

5. A method according to any of the claims 1 to 5, **characterised** in that said multitude of nodes are voice gateways.

6. A node for routing incoming calls to a first subscriber towards a specific node, said first subscriber using a telecommunication network for connecting to Internet and said node being connected to both Internet and said telecommunication network, **characterised** in that said node comprises means for receiving a call diverted from said first subscriber, that said node comprises means for selecting one specific node from a multitude of nodes connected both to Internet and to said telecommunication network in dependence of the telephone number of said first subscriber and that said node comprises means for diverting said call to said specific node.

7. A network for routing incoming calls to a first subscriber towards a specific node, said first subscriber using a telecommunication network for connecting to Internet and said node being connected to both Internet and said telecommunication network, **characterised** in that said network comprises a service node, that said network comprises means for diverting said call to said service node, that said service node comprises means for selecting one specific node

from a multitude of nodes connected both to Internet and to said telecommunication network in dependance of the telephone number of said first subscriber and that said network comprises means for diverting said call to said specific node.

1 / 2

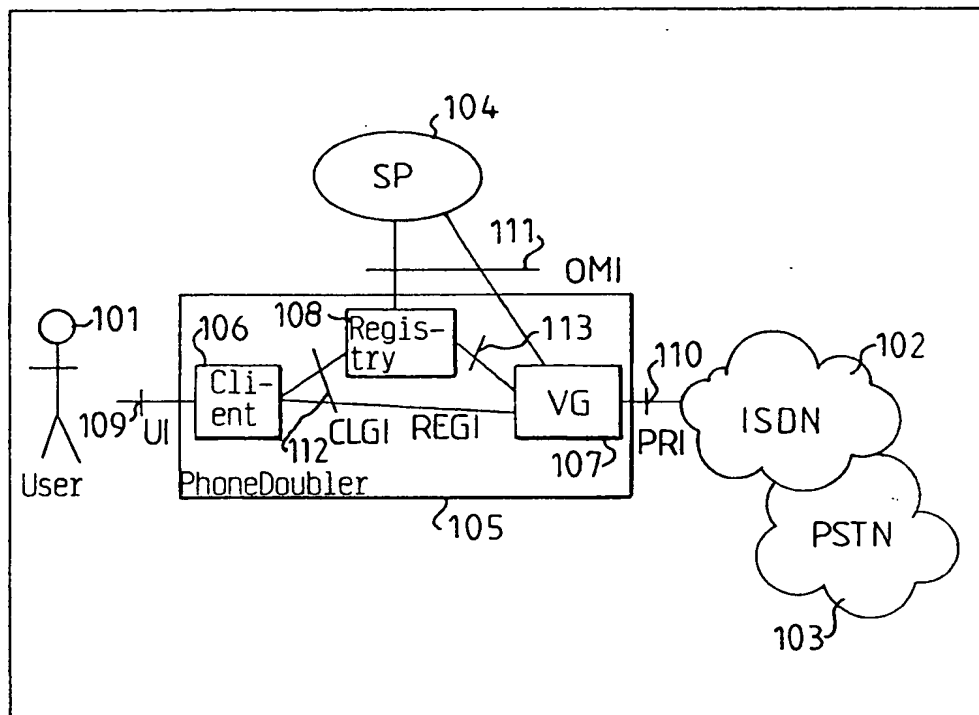


FIG. 1

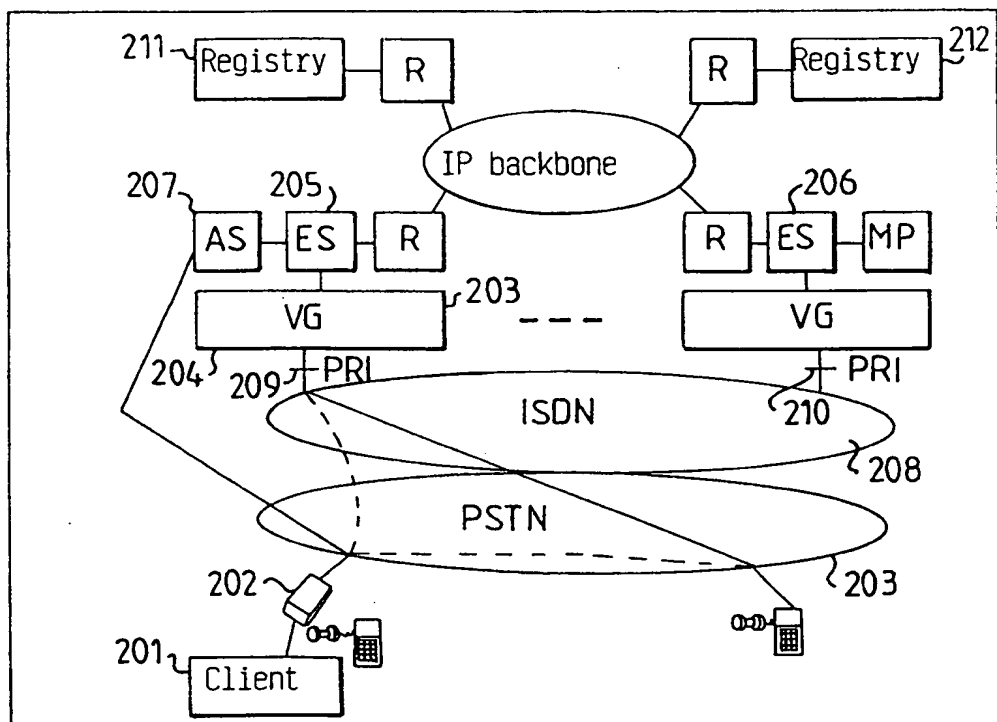


FIG. 2

2/2

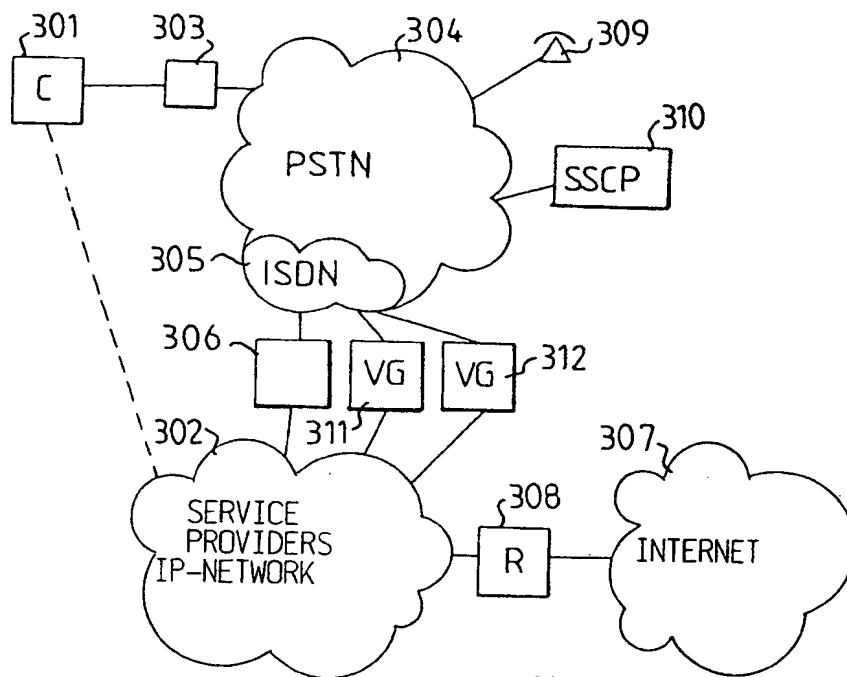


FIG. 3

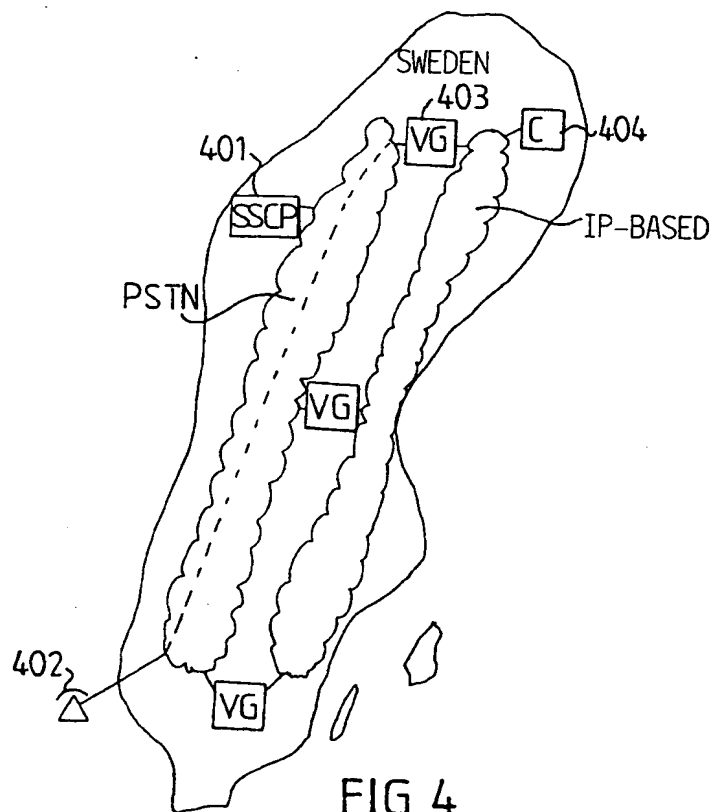


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 98/00331

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04Q 3/66, H04M 3/54 // H04L 12/66

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04Q, H04M, H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 9638018 A1 (TELEFONAKTIEBOLAGET LM ERICSSON (PUBL)), 28 November 1996 (28.11.96), figure 1, abstract --	1-7
Y	EP 0647051 A1 (AT & T CORP.), 5 April 1995 (05.04.95), figure 1, abstract --	1-7
A	EP 0740445 A2 (ROCKWELL INTERNATIONAL CORPORATION), 30 October 1996 (30.10.96), column 2, line 25 - column 4, line 18 --	1-7

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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Date of the actual completion of the international search

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8 July 1998

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INTERNATIONAL SEARCH REPORT

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0753956 A2 (ROCKWELL INTERNATIONAL CORPORATION), 15 January 1997 (15.01.97), column 2, line 23 - column 3, line 18 --	1-7
P,A	WO 9714238 A1 (INTERNATIONAL DISCOUNT TELECOMMUNICATIONS CORP.), 17 April 1997 (17.04.97), page 4, line 15 - page 5, line 2 -- -----	1-7

INTERNATIONAL SEARCH REPORT

Information on patent family members

30/06/98

International application No.

PCT/SE 98/00331

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9638018 A1	28/11/96	AU 5916696 A EP 0829181 A FI 952557 D NO 975343 A FI 961690 A	11/12/96 18/03/98 00/00/00 21/01/98 25/11/96
EP 0647051 A1	05/04/95	CA 2129942 A JP 7170546 A US 5633924 A	31/03/95 04/07/95 27/05/97
EP 0740445 A2	30/10/96	CA 2173304 A	22/10/96
EP 0753956 A2	15/01/97	US 5619557 A	08/04/97
WO 9714238 A1	17/04/97	NONE	

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